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Aumercier

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[54] **LINKAGE ASSEMBLIES FOR HORIZONTALLY AND VERTICALLY PIVOTAL CLOSURES**

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[51] **Int. Cl.**[5] **E05D 15/30**

[52] **U.S. Cl.** **403/53;** 49/248; 49/252

[58] **Field of Search** 403/53, 54, 116; 49/248, 252, 251, 250

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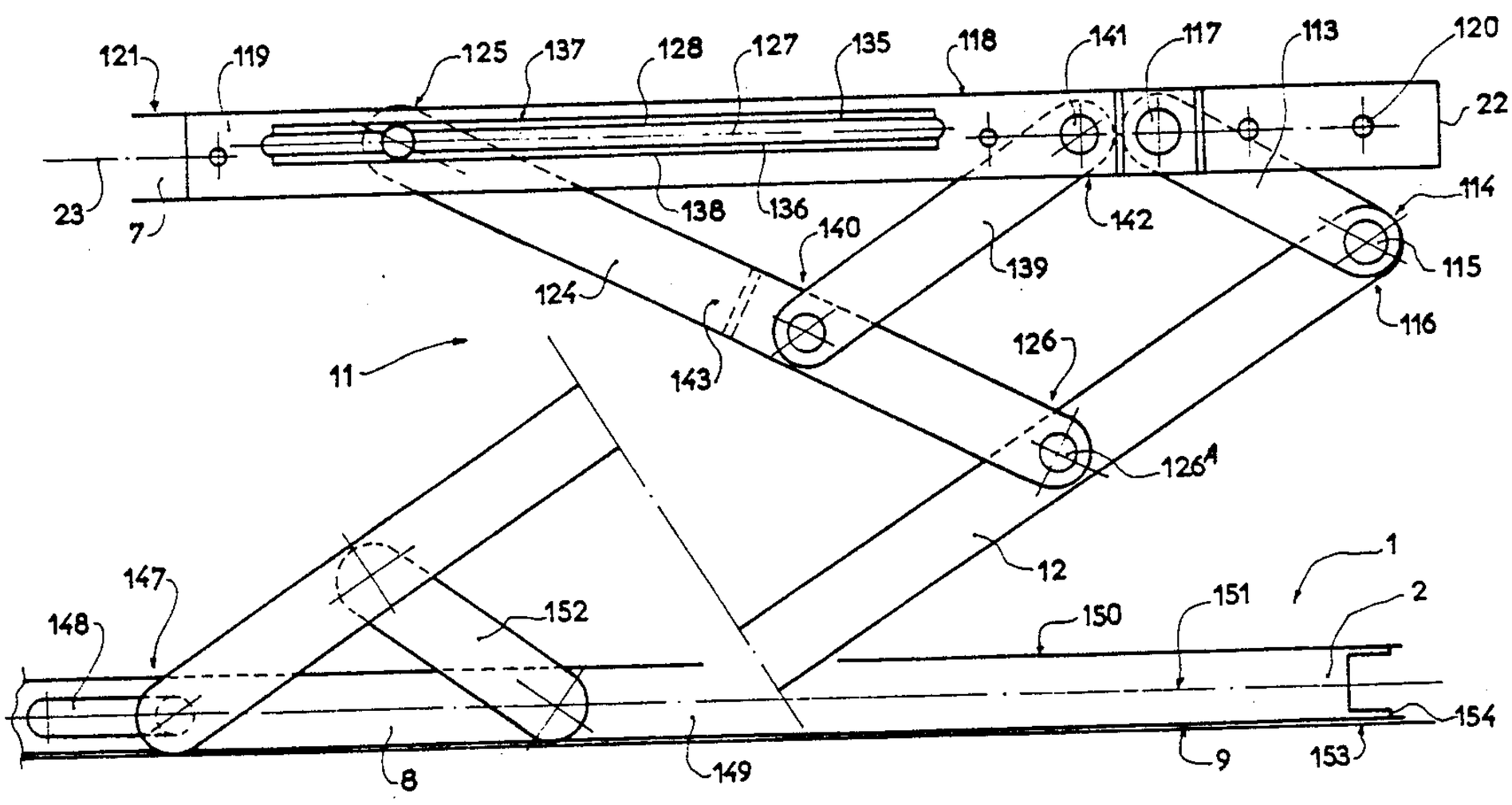
Attorney, Agent, or Firm—Sandler, Greenblum & Bernstein

[57] **ABSTRACT**

Linkage assemblies for doors or windows, in which the leaf frame is partly lap-jointed to the fixed frame, where an upper and lower assembly are respectively fixed in fillisters, both assemblies of which include an auxiliary compass arm. The upper and lower assemblies are each also fitted with a second compass arm of which one extremity is mounted slidingly in the lower and upper rail of the fixed frame. The configuration of the assemblies enable the offsetting, in the course of French opening, the rear stile of the leaf frame in the relation to the rear stile of the fixed frame. The doors or window, which can be of considerable size and weight, nevertheless are securely supported for the aforementioned movement, including movement about a vertical axis through an angle of opening of more than ninety degrees.

17 Claims, 3 Drawing Sheets



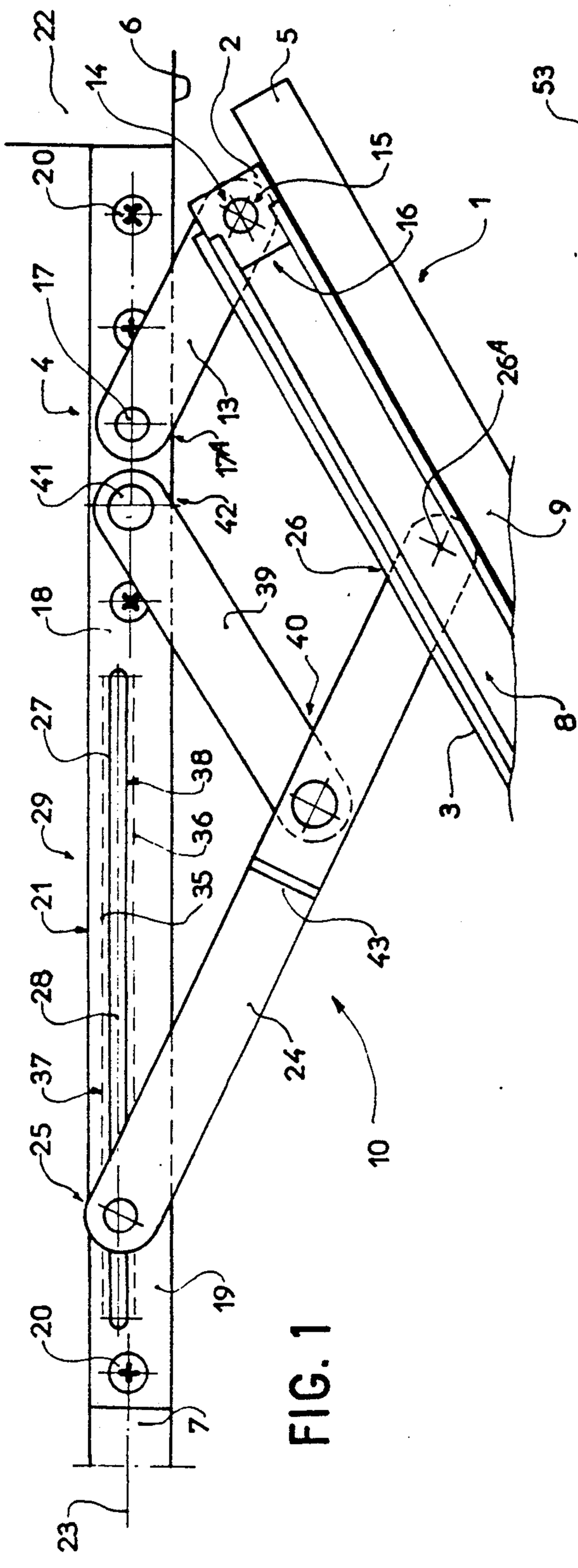

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FIG. 1

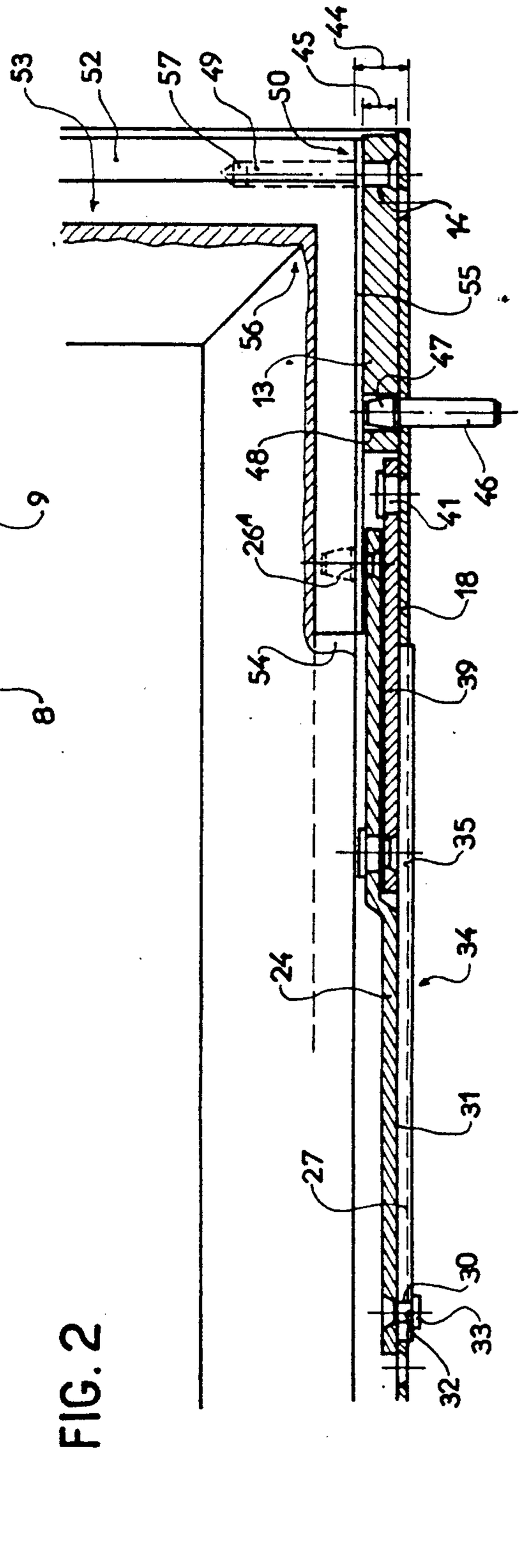
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FIG. 2

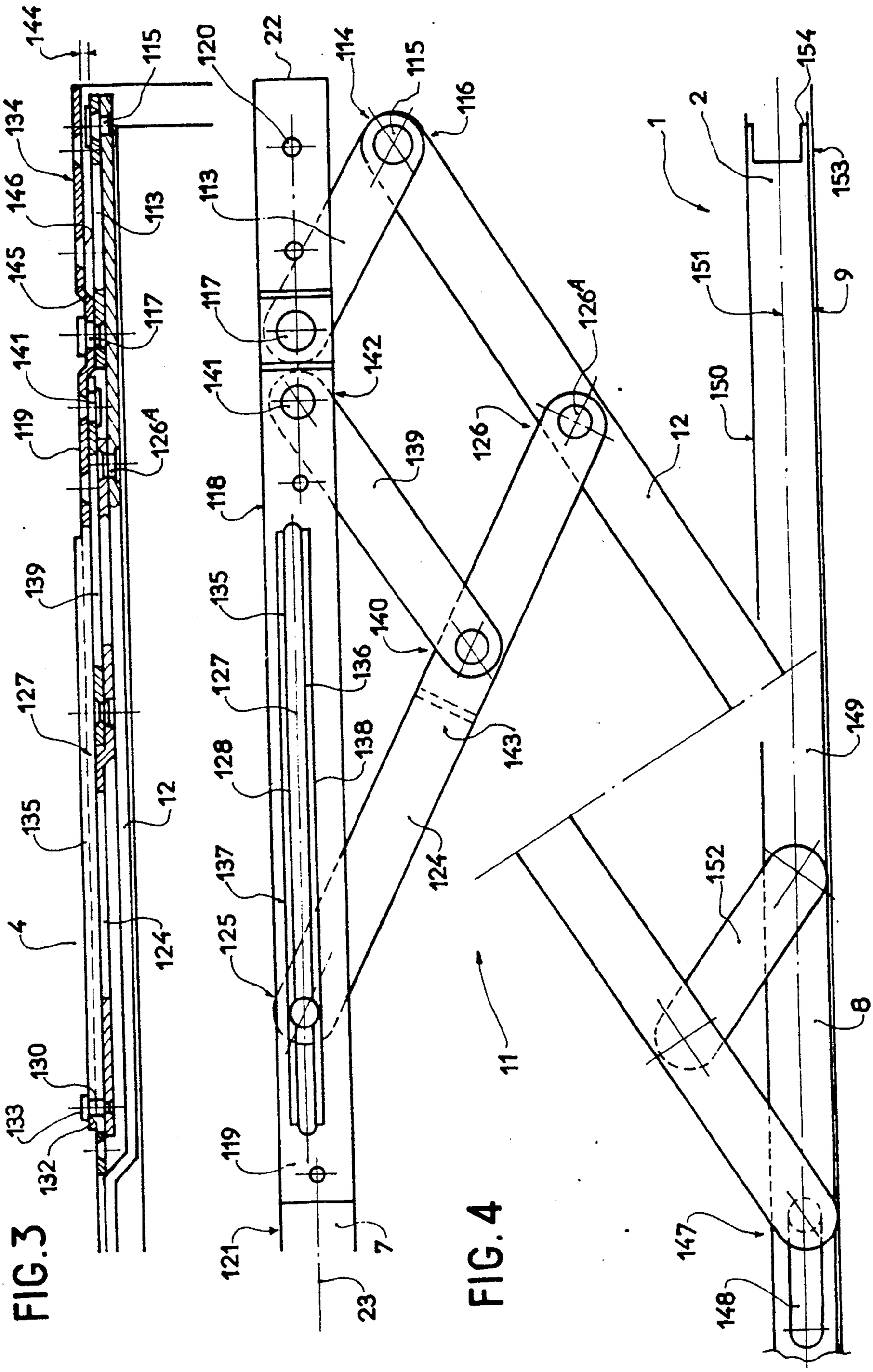
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FIG. 3

FIG. 4

FIG. 9

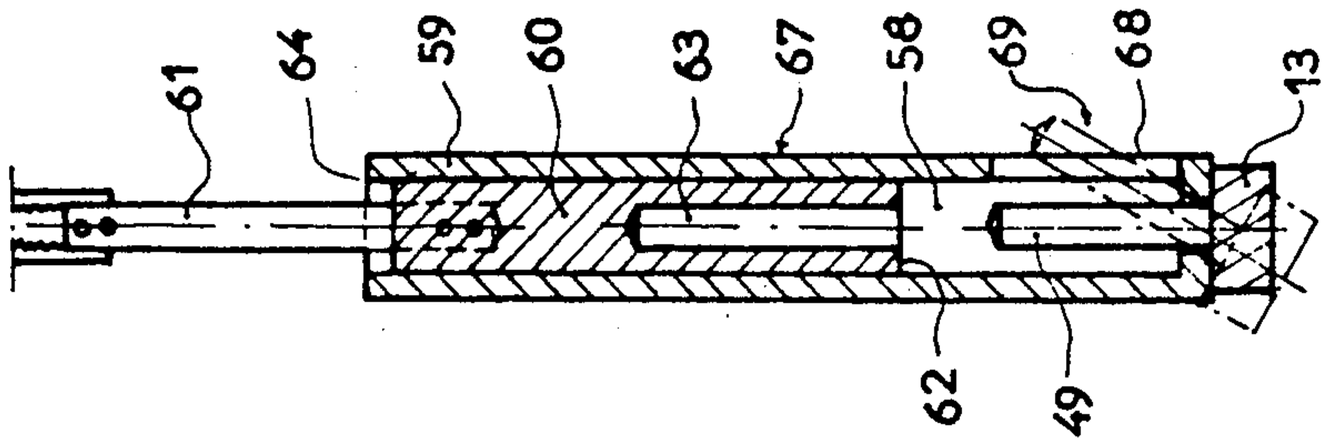


FIG. 8

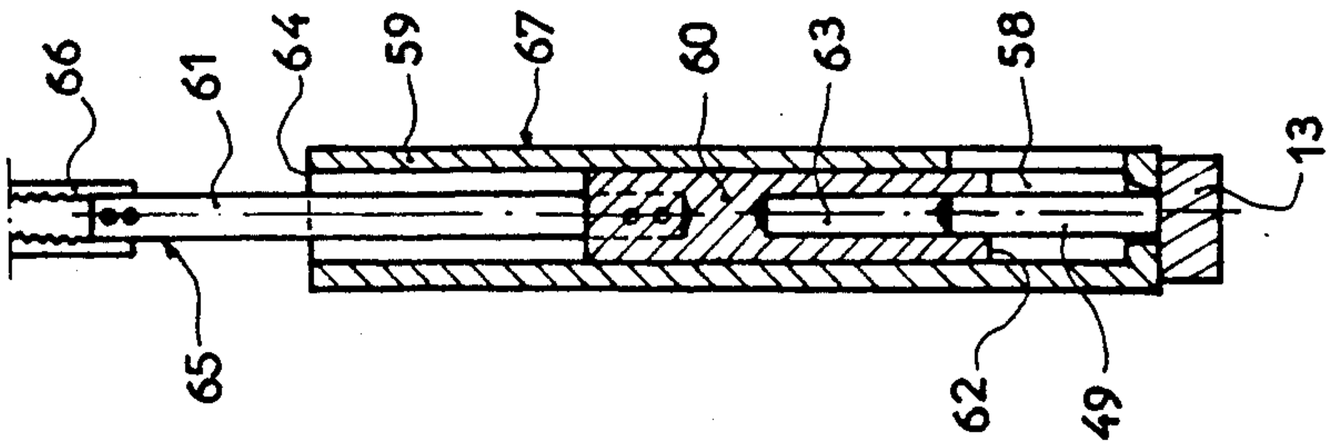


FIG. 7

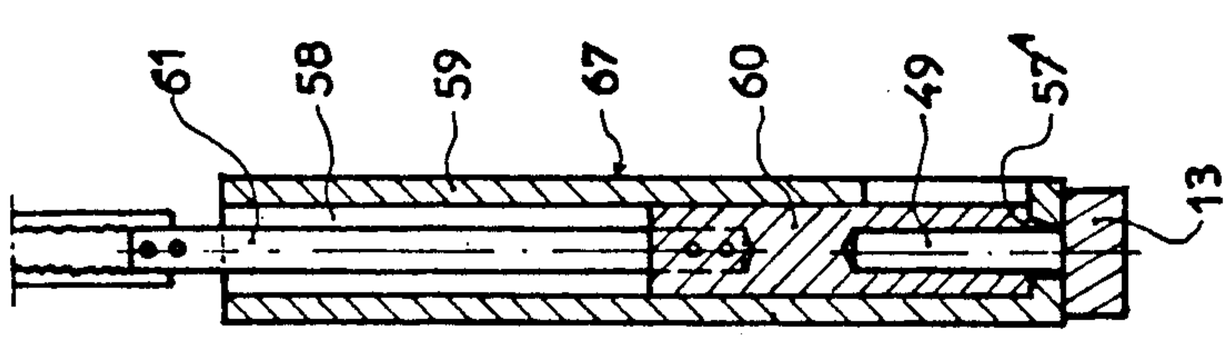


FIG. 6

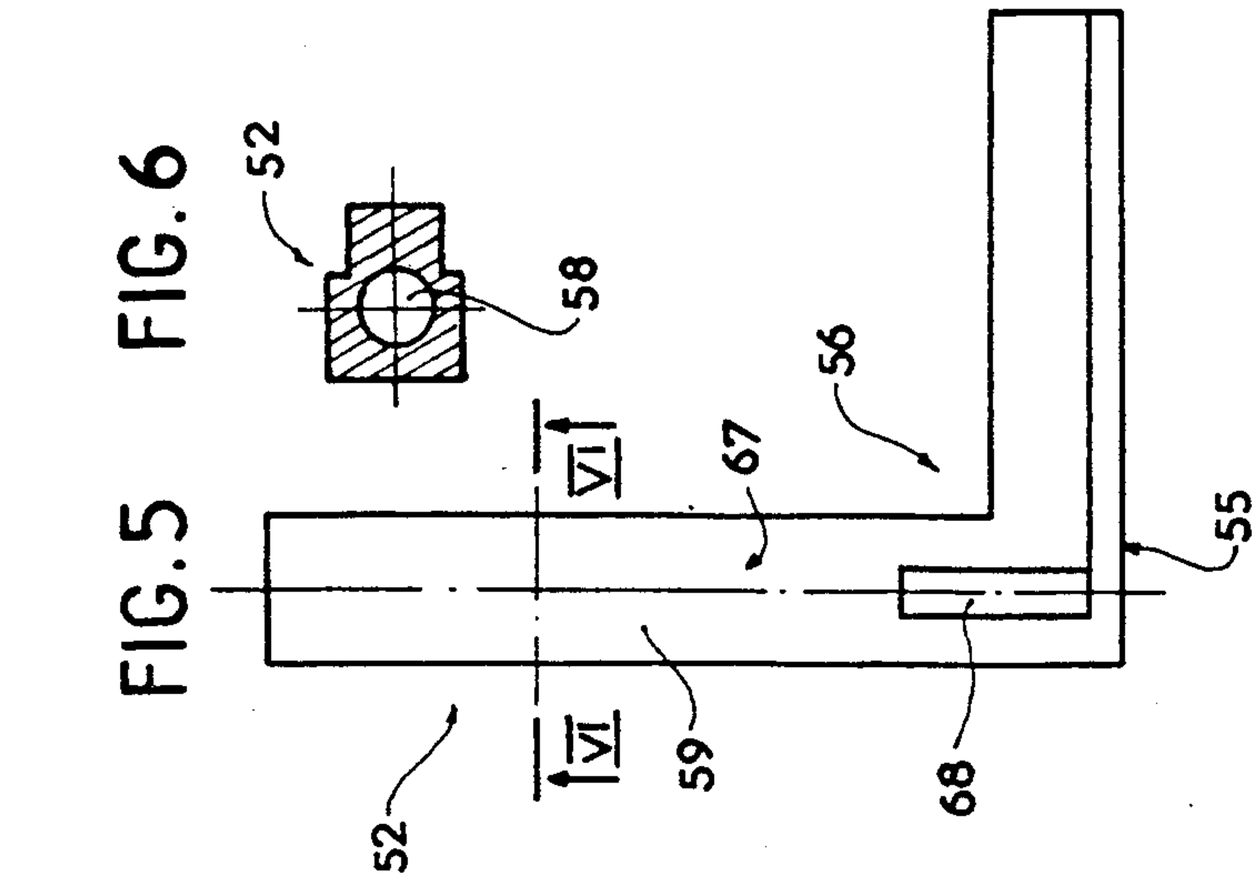
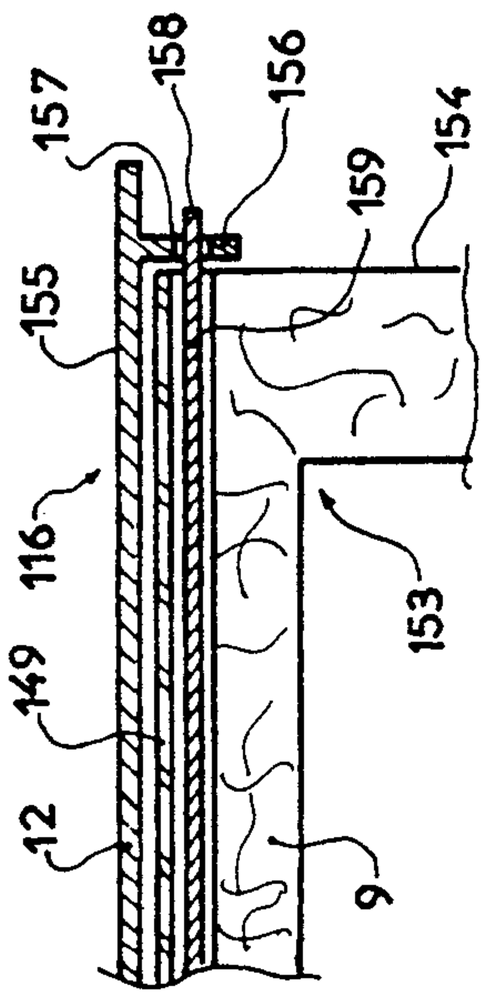


FIG. 10



LINKAGE ASSEMBLIES FOR HORIZONTALLY AND VERTICALLY PIVOTAL CLOSURES

BACKGROUND OF THE INVENTION

The invention concerns joint fittings, or linkage assemblies for tipping and turning doors, windows or similar closures, i.e., such closures being selectively pivotal about either a vertical or horizontal axis, of which the leaf frame is partly lap-jointed with the window casing frame, composed of a stop compass and an angle bracket fixed in fillisters and both comprising an auxiliary compass arm linked, one the one hand, to the upper, or respectively lower rail of the window casing frame and, on the other hand, to the main compass arm cooperating with the upper rail of the leaf frame or, respectively, to the lower rail of the latter.

Joint fittings for tipping doors or windows housed in fillisters of the leaf frame and of the window casing frame and corresponding to the above description are already known.

Thus, these fittings are composed of a joint element known as a stop compass, associated with the upper part of the door or window, their function consisting, on the one hand, of ensuring the rotation of the leaf around a vertical axis in a French window opening and, on the other hand, of limiting the tipping of this leaf in the tipped position.

They comprise, in addition, another joint element known as an angle bracket, placed in the lower part of the door or window and permitting, alternatively, a tipping of the leaf around a horizontal axis and a pivoting of the leaf around a vertical axis of rotation.

For aesthetic reasons, but also to improve security, the present trend is to insert these jointing elements in fillisters of the leaf and of the window casing frame of the door or window.

Thus, a known assembly includes a stop compass formed of a main compass arm, the extremities of which are mounted sliding, respectively, on the upper rail of the leaf and the upper rail of the window casing frame. In addition, a first link is placed between the compass arm and the leaf frame, and a second link connects the same compass arm to the window casing frame.

Also known is an angle bracket composed of, on the one hand, a vertical spindle inserted in the extremity of the lower rail of the leaf, hinge side, and comprising a roller, mounted sliding in a slide fixed on the lower rail of the window casing. On the other hand, a link connects the latter to the leaf.

The effect of this device is to cause the staggering, following movement in a direction parallel to the plane of the door or window, of the axis of rotation of the leaf in French window opening, and in this way to disengage the rear stile of this leaf in relation to the window frame.

In the case of opening by tipping, only the existing play of the spindle, fitted with its roller, in the slide situated on the window case, permits the leaf to pivot around a horizontal axis.

In fact, the solution corresponding to this known angle bracket and stop compass corresponds only to doors or windows, the leaf of which is flush with the window frame. In the case of partial lap-jointing, and because of the position in the fillisters of the imaginary axis of rotation of the leaf, it is necessary, in French

window openings, to offset this imaginary axis of rotation outside the vertical plane of the door or window.

For this purpose, stop compasses and angle brackets have been designed which are more or less identical to those described above, and which also comprise an auxiliary compass arm connected by means of jointing to either the upper or lower rail of the window frame and to the rear extremity of the main compass arm to the lower rail of the leaf. This layout, however, has imposed the sliding mounting of the various links referred to above on this lower rail of the leaf or on the main compass arm.

The result is that, at the moment a French window is opened, the rotation of the auxiliary compass arm causes the staggering, in relation to the window frame, of the rear stile of the leaf and, simultaneously, the offsetting of the imaginary axis of rotation of the latter outside the plane of the door or window, more precisely towards the interior of the dwelling.

Although providing a solution to the problem of leaves partially lap-jointed to the window frame, described above, these joint fittings nevertheless have a disadvantage, i.e. their application is limited to leaves of reduced size and weight.

Because of the offset of the leaf outside the window frame, in a French window opening, the auxiliary compass arm and the link of the angle bracket have to support the whole weight of the leaf. These constraints tend to increase in proportion to the angle of opening of the door or window. Moreover, the proximity of the joints connecting the link and the auxiliary compass arm to the window frame raises security problems if their fixing is torn off the respective support, in particular in the maximum French window opening position.

Solutions have been proposed to compensate for the load constituted by the leaf fixed with such recessed locking fittings. In particular, a supplementary compass arm has been added to the angle bracket in the attempt to create a point of connection to the window frame distant from the imaginary axis of rotation of the leaf and, in particular, of the joint of the auxiliary compass arm connecting it to the lower rail of this window frame. In addition, this supplementary compass arm is inserted, at one of its extremities, sliding on the lower rail of the leaf.

Now an assembly of this kind necessarily limits the angle of French window opening to ninety degrees, which in fact constitutes an inconvenience.

SUMMARY OF THE INVENTION

The aim of this invention is to overcome the above-mentioned disadvantages by proposing joint fittings for tipping doors or windows of a design that is simple and reliable but also provides a solution to the problem of the weight of large leaves.

For this purpose, the invention concerns joint fittings for tipping windows or doors of which the leaf frame is partially lap-jointed to the window frame, composed of a stop compass and an angle bracket fixed in the fillisters, and both comprising an auxiliary compass arm connected, on the one hand, to the upper or respectively lower rail of the window frame and, on the other hand, to the main compass arm cooperating with the upper rail of the leaf frame or, respectively, to the lower rail of the latter, these joint fitting being characterized by the fact that the stop compass and the angle bracket comprise:

a second compass arm mounted sliding at one of its extremities on the upper or, respectively, the lower rail of the window frame, the other extremity being linked, by means of jointing, to this main compass arm or, respectively, to the lower rail of the leaf frame

and a link of which one extremity is jointed to this second compass arem, the other extremity being fixed pivoting on the upper or respectively lower rail of the window frame.

The advantages obtained through this invention consist essentially in the fact that the sliding connection of the second compass arm to the upper or lower rail of the window frame permits the point of attachment it constitutes to the window frame to be removed as far as possible from the point of articulation of the auxiliary compass arm on the same upper and lower rails. This gives a better distribution of the load constituted by the leaf on these joint fittings and, more particularly, on the angle bracket.

This advantage is not obtained, however, at the expense of the angle of rotation of the leaf in a French window opening, since the angle can reach values of considerably more than ninety degrees.

In addition, the advantage of joint fixings of identical design to achieve both the lower and upper connection of a tipping leaf to the window frame of the door or window is that it permits some of their elements to be standardized, and this simplifies manufacture and stocking.

BRIEF DESCRIPTION OF THE DRAWINGS

Othe aims and advantages of this invention will be made apparent in the following description. This description will be easier to understand if reference is made to the attached drawings, in which:

FIG. **1** is a schematic plan view of an angle bracket according to the invention and applied to a door or window of which the leaf is in the French window opening position;

FIG. **2** is a schematic view in section of the angle bracket represented in FIG. **1**;

FIG. **3** is a schematic view in elevation and in section of a stop compass according to the invention and applied to a door or window of which the leaf is in the tipped position;

FIG. **4** is a schematic plane view of the stop compass represented in FIG. **3**;

FIG. **5** is a schematic view in elevation of the angular lever which fixes in the lower angle of the leaf frame and forms one of the elements constituting the means of jointing connecting the auxiliary compass arm to this leaf frame;

FIG. **6** is a view in section along VI—VI of FIG. **5**;

FIG. **7** is a schematic view in section of the means of jointing linking, at the level of the angle bracket, the auxiliary compass arm to the leaf frame, the latter being in the locked position;

FIG. **8** is a view identical with FIG. **7**, the leaf being in the French window opening position;

FIG. **9** is a view identical with FIGS. **6** and **7** above, the leaf being in the tipped opening position;

FIG. **10** is a detail view of the upper angle of the leaf frame represented in schematized form and in section.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The joint fittings according to the invention and represented in FIGS. **1** to **4** are applicable to doors or windows of which the leaf **1** is of the tipping type and for which leaf **1** is able to pivot around a vertical axis, passing by the rear stile **2** and corresponding to the so-called French opening position. Moreover, the leaf **1** can tip around a horizontal axis, frequently realized by its lower rail **3**, this opening corresponding to the tipped position.

Among the different tipping and turning leaves, we distinguish those partially lap-jointed to the window frame **4**. Such leaves **1** have on their periphery an edge **5** which, in the closed position, is applied against the inner face **6** of the window frame **4**, thus improving the sealing of the door or window.

This invention applies, more precisely, to such leaves, and concerns joint fittings placed in fillisters **7**, **8** of the window frame **4** and of the leaf frane **9**.

These joint fittings are composed of an angle bracket **10** providing the lower linkage assembly of the leaf **1** to the window frame **4**, and a stop compas **11** constituting the upper linkage assembly of the this way, the angle bracket **10** makes it possible to confer on the leaf **1** both a rotation around a vertical axis and a rotation around a horizontal axis, while the stop compass **11** assures the pivoting around a vertical axis of the main compass **12** which, because of its link to the leaf **1**, passes on this rotation to the latter. In addition, this stop compass **11** makes it possible to limit the angle of tipping of the leaf **1** when it rotates around the horizontal axis.

More exactly, the angle bracket **10**, as represented in FIGS. **1** and **2** comprises, on the one hand, an auxiliary compass arm **13** connected, at one of its extremities **14**, with the aid of means of jointing **15**, to the lower rail **3** of the leaf frame **9**. Preferentially, the connection of the auxiliary compass arm to the leaf **1** is situated as closely as possible to the lower angle **16** of the latter. A joint **17** connects the auxiliary compass arm **13** to the window frame **4** and, in particular, to a support **18** formed by an elongated plate **19** inserted, with the aid of fixing elements **20**, in the fillisters **7** on the lower rail **21** of this window frame **4**.

The main purpose of the auxiliary compass arm **13** consists, during French opening, in clearing the rear stile **2** of the leaf **1** in relation to the rear stile **22** of the window frame **4** and, simultaneously, offsetting this leaf **1** according to a direction perpendicular to the vertical plane **23** of the door or window. This offset is made, preferably, in the direction of the interior of the dwelling.

It should in fact be noted that because of the placing of joint fittings in fillisters, it is indispensable to confer on a leaf partially lap-jointed with the window frame **4** kinematics of this kind, without which its peripheral edge **5** cooperates with the inner face **6** of the window frame **4** and prevents it from rotating around a vertical axis, thus preventing French opening.

On the other hand, the angle bracket **10** comprises, according to one characteristic of the invention, a second compass arm **24** linking the leaf frame **9** to the window frame **4**. More precisely, the second compass arm **24** is slidably mounted, at one of its extremities **25**, on the lower rail **21** of the window frame **4**, while the other extremity **26** is fixed, by a joint **26A**, in fillister **8** and on the lower rail **3** of the leaf frame **9**.

According to a preferential mode of implementation, the sliding mounting of the second compass arm **24** on the window frame **4** is obtained by means of a slide **27** disposed in the support **18** applied on the lower rail **21** of the window frame **4**. This slide **27** consists of an

oblong opening **28** disposed in the plate **19** and, in particular, in its front part **29** oriented towards the front stile of the window frame **4**. Engaged in the opening **28** is a pivot **30** fixed to the extremity **25** of the second compass arm **24** and projecting from the lower face **31** of the latter. This pivot **30** is also fitted, at its free extremity **32**, with a cheek **33** cooperating with the lower side **34** of the plate **19**. In this way it avoids the sudden disengagement of the second compass arm **24** from the slide **27** during the manipulation of the leaf **1**.

Preferentially, edges **35, 36** are disposed on the lower side **34** of the plate **19**, at the level of the longitudinal edges **37, 38** of the opening **28**. This characteristic makes it possible significantly to improve the quality of the guiding of the pivot **30**, thus contributing to a reduction of the play between the different parts constituting the angle bracket **10**. This this improvement, however, in no case results in increasing the thickness of the plate **19**. The fact is that these edges **35, 36** can be obtained by a simple and inexpensive operation of swaging.

Advanageously, the angle bracket **10** is also fitted with a link **39** jointed, at one of its extremities **40**, onto the second compass arm **24** and cooperating, by means of a joint **41**, and at its opposite extremity **42** with the support **18** or the plate **19**. The main function of the link **39** is to distribute the action of the compass arms **13** and **24** over the leaf **1**. For this purpose, the joint **41**, connecting the link **39** to the support **18**, is preferably situated between the opening **28** and the means of jointing **15** of the auxiliary compass arm **13**. In fact the joint **41** of the link **39** is disposed as near as possible to these means of jointing **15** so as to permit the largest possible angle of opening of the leaf **1**. Because of the characteristics of this invention, the angle of opening of the leaf **1** can reach values well over ninety degrees.

It should also be noted that in the position perpendicular to the vertical plane **23** of the door or window, the leaf **1** comprises points of attachment to the window frame **4** which are relatively distant from one another. This assures perfect stability whatever the weight and the size of the leaf.

According to a preferential mode of implementation of the invention, the second compass arm **24** is cambered in its middle **43**, permitting the insertion of the link **39** between this second compass arm **24** and the plate **19** in the closed position of the leaf **1**. Care has been taken, however, to see that the overall thickness **44** of the angle bracket **10** is kept less than the play between the fillisters **7, 8** of the window frame **4** and the leaf frame **9**, so as to avoid any recessing of one or the other of the latter.

The auxiliary compass arm **13** being situated, in the closed position, in the prolongation of the second compass arm **24** and the link **39**, is chosen with a thickness **45** equivalent to the sum of the latter. So this auxiliary compass arm **13** is strengthened and can thus support the weight constituted by the leaf **1** when the latter is offset outside the vertical plane **23** of the door or window.

In the same objective of giving mechanical resistance to the angle bracket **10**, in case of the application of the invention to large and heavy leaves, the joint **17** connecting the auxiliary compass arm **13** to the window frame **4** is formed by a vertical spindle **46** introduced amply into the lower rail **21** of the latter. Moreover, the extremity **47** of this vertical spindle **46**, projecting from the support **18**, is engaged in a boring **48** made in the extremity **17A** of this auxiliary compass arm **13**.

Concerning the stop compass **11**, apart from the main compass arm **12**, it has a structure essentially identical with that of the angle bracket **10**. Thus, as represented in FIGS. **3** and **4**, it comprises an auxiliary compass arm **113**, connected at one of its extremities **114** and by means of a joint **115** to the rear extremity **116** of the main compass arm **12**. In addition, a joint **117** ensures the connection of this auxiliary compass arm **113**, at its opposite extremity, to a support **118** formed by an elongated plate **119** locked, by means of fixing elements **120** in fillister **7**, to the upper rail **121** of the window frame **4**.

The stop compass **12** is also provided with a second compass arm **124** of which one extremity **125** is mounted sliding in a slide **127** disposed in the support **118**. The other extremity **126** of the second compass arm **124** is locked to the main compass arm **12** with the aid of a joint **126A**.

The structure of the slide **127** is identical with that described for the angle bracket **10**. Thus, it is formed by an oblong opening **128** made in the plate **119**. This comprises, on its face **134**, oriented in the direction of the upper rail **121** of the window frame **4**, edges **135, 136** situated on the longitudinal edges **137, 138** of the opening **128**. Engaged in this slide **127** is a pivot **130** in one piece with the extremity **125** of the second compass arm **124**, the pivot **130** having at its free extremity **132** a cheek cooperating with the edges **135, 136** and preventing its disengagement from the opening **128**.

A link **139**, mounted jointed at one of its extremities on the second compass arm **124**, also connects the latter to the upper rail **121** of the window frame **4**. For this purpose, the link **139** cooperates, at its extremity **142**, with the support **118** by means of a joint **141** disposed in the immediate proximity of the joint **117** connecting, to this same support **118**, the auxiliary compass arm **113**.

The second compass arm **124** like the first compass arm, is cambered in its middle **143** permitting, in the closing position, the link **139** to be engaged between this second compass arm **124** and the plate **119**. However, the auxiliary compass arm **113** is not necessarily strengthened, since it contributes only to a small extent to supporting the weight of the leaf. In these conditions, the gap **144** between the auxiliary compass arm **113** and the plate **119** is compensated by a lug **145** on the lower face **146** of the latter, and on which is mounted the joint **117**.

In the context of the angle bracket **10**, as well as the stop compass **11**, the joints **17, 117** and **41, 141** are as close as possible to one another and disposed as near as possible to the rear stile **22** of the window frame **4**.

The main compass arm **12** is connected to the leaf **1** by techniques known to any professional. Thus, the front extremity **147** is fitted with a pivot (not represented) mounted sliding in an oblong opening **148** made in a face-plate **149** disposed in fillister **8** on the upper rail **150** of the leaf frame **9**. More precisely, this face-place **149** covers a groove **151** made in the periphery of the leaf **1**, and in which slide control rods activated by a locking mechanism such as an espagnolette or espagnolette lock. In addition, a link **152** connects the main compass arm **12** to the leaf frame **9**, preventing it from shifting in relation to the window frame **4** in the case of opening by tipping.

The maintenance of the main compass arm **12** on the face-plate in the French opening position can be assured by any known means such as keepers in one piece with the main compass arm **12**. In this way, the keepers are

able to cooperate with locking devices fixed on a control rod and emerging from the faceplate **149** through openings made for this purpose. However, because of the space occupied by the stop compass **11** in fillisters **7**, **8** of the window frame **4** and of the leaf frame **9**, it would be necessary considerably to stagger these keepers in relation to the vertical axis of rotation of the leaf **1**. Now in these condiitions, the least play between the keeper and the locking device disposed on the control rod results, for leaves of considerable breadth, in a play of several millimeters in the area of their rear stile.

To overcome this disadvantage, as represented in FIG. **10**, the rear extremity **116** of the main compass arm **12** is elongated by a section folded back in the form of an angular lever which, in the French opening position, caps the upper angle **153** of the leaf frame **9** and, in particular, of the face-plate **149**. In the vertical wing **156** of this section folded back in the form of an angular lever, an opening **157** is made, in which is engaged the extremity **158** of a control rod **159**, emerging from the rear vertical edge **154** of the leaf frame **9**. Conversely, the operation of the espagnolette or espagnolette lock, during tipping opening, causes the withdrawal of the protruding extremity **158** of the control rod **159**, thus freeing the main compass arm **12**.

Concerning the pivoting of the leaf frame **9** in relation to the window frame **4**, parallel to a horizontal plane of rotation, it can be made possible due to sufficient play at the level of the joint **17** connecting the auxiliary compass arm **13** to the support **18**.

More precisely, the salient extremity **47** of the spindle **46** which has been referred to in the description above, is of conical shape and introduced into the boring **48** made in the extremity **17A** of the auxiliary compass arm **13**. This configuration permits the latter to pivot in a limited angle through a horizontal plane axis.

In these conditions, the means of jointing **15** connecting this same auxiliary compass arm **13** to the leaf **1**, consist of a vertical spindle **49**, locked at its lower extremity **50** to the free extremity **14** of the auxiliary compass arm **13**. In adittion, an angular lever **52** caps the lower angle **16** of the leaf **1** and fits into the recesses **53**, **54** made in the rear stile **2** and the lower rail **3** of the leaf **1** and serving to house the control rods and the faceplate. The angular lever **52** is locked to the leaf **1** by fixing elements such as screws or similar means and comprises, in its lower edge **55** and in the angle **56**, a cylindrical recess of dimensions adjusted to those of the spindle **49** to permit the latter to pass and to rotate.

In certain cases, particularly for ranges of more or less large leaves, this play at the level of the connection of the auxiliary compass arm **13** to the support **18** can represent a disadvantage by causing more rapid fatigue of the parts constituting the joint fittings.

In these conditions, and according to another mode of implementation according to the invention and represented in FIGS. **5** to **9**, the salient extremity **47** of the spindle **46** is adjusted to the diameter of the boring **48** in the auxiliary compass arm **13** in such as way as to permit the latter to rotate only about a horizontal axis.

In addition, the vertical spindle constituting part of the means of joining **15** of the auxiliary compass arm **13** to the leaf frame **9** is introduced into an oblong opening **57A** machined in the lower edge **55** and in the angle **56** of the angular lever **52**. This oblong opening **57A** communicates with a recess **58**, preferably cylindrical, having a vertical axis and made formed in the vertical wing **59** of the angular lever **52**. A socket **60**, in one piece with a transmission rod **61**, slides in the recess **58** and cooperates with the vertical spindle **49**.

More precisely, the socket **60** has on its lower face **62** a recessed hole **63** adjusted to the diameter of the vertical spindle **49** to permit its introduction.

The transmission rod **61**, connected to the socket **60**, emerges from the recess **58** at the level of the upper edge **64** of the vertical wing **59** corresponding to the angular lever **52**. The transmission rod **61** is thus able to cooperate, at its upper extremity **65** and with the aid of means of connection **66**, with a control rod (not represented). This is housed in the recess **53** made in the rear stile **2** of the leaf **1** and cooperates with the locking mechanism, such as an espagnolette or espagnolette lock.

Hence, from the action of this control rod, operated by the locking mechanism, the socket **60** is made to slide in the recess **58** of the angular lever, cooperating or otherwise, according to the case, with the vertical spindle **49**. More exactly, in the closed position of the leaf **1**, corresponding to FIG. **7**, the socket **60** is totally engaged in the vertical spindle **49**. By activating the locking mechanism to bring about the French opening of the door or window, the play of the control rods causes the socket **60** to rise, thus being maintained in position partially engaged in the vertical spindle **49** as may be seen in FIG. **8**. In this case the vertical spindle **49** is able to pivot about a vertical axis.

Finally, in the tipping opening position of the leaf **1**, corresponding to the configuration of the means of jointing **15** as shown in FIG. **9**, the socket **60** is totally lifted in the recess **58**, freeing the vertical spindle **49**.

Hence, and because of the oblong opening **57A** made in the angular lever **52**, the latter can pivot around a horizontal axis. However, to avoid limiting the angular displacement of the vertical spindle **49** within the recess **58**, the angular lever **52**, and in particular the vertical wing **59** has, close to the angle **56** and on its face **67** oriented towards the outside of the door or window, an opening **68**. The latter, thus disposed to the right of the vertical spindle **49**, allows the free extremity **69** of the spindle to emerge from the angular lever **52** in the maximum tipping position of the leaf **1**.

A configuration such as this undeniably improves the behavior of the leaf frame **9** in relation to the window frame **4** in the case of French opening of the door or window.

Consequently, the angle bracket **10** and the stop compass **11**, according to this invention, contribute undeniable advantages in the field of recessed joint fittings for tipping and turning doors or windows. Their particular design allows them to be applied to leaves of considerable size and weight with impeccable reliability, at the same time assuring an angle of French opening of more than ninety degrees. Hence these joint fittings according to the invention combine effectiveness with aesthetic qualities.

I claim:

1. A linkage assembly for a closure having at least one leaf which is movably mounted relative to a fixed frame from a closed position in which said leaf is lap-jointed to said fixed frame, to an open position, wherein said leaf is selectively pivotable about a horizontal or a vertical axis, said linkage assembly comprising:

(a) an upper linkage assembly comprising:

(i) a main compass arm connected to said leaf;

(ii) a first upper auxiliary compass arm pivotally connected to said main compass arm and pivotally connected to said fixed frame;

(iii) a second upper compass arm pivotally connected to said main compass arm and slidably connected to said fixed frame; and

(iv) an upper link pivotally connected to said second upper compass arm and pivotally connected to said fixed frame; and

(b) a lower linkage assembly comprising:

(i) a first lower auxiliary compass arm pivotally connected to a lower portion of said leaf and pivotally connected to a lower portion of said fixed frame;

(ii) a second lower compass arm pivotally connected to said leaf and slidably connected to said fixed frame; and

(iii) a lower link pivotally connected to said second lower compass arm and pivotally connected to said fixed frame.

2. The linkage assembly of claim **1**, further comprising an upper fillister, within which said upper linkage assembly is at least partially enclosed, and a lower fillister, within which said lower linkage assembly is at least partially enclosed, at least in said closed position of said leaf.

3. The linkage assembly of claim **2**, wherein said upper linkage assembly further comprises an upper elongated support plate fixed within said upper fillister to which said first upper auxiliary compass arm, said second upper compass arm, and said upper link are connected, and wherein said lower linkage assembly further comprises a lower elongated support plate fixed within said lower fillister to which said first lower auxiliary compass arm, said second lower compass arm, and said lower link are connected.

4. The linkage assembly of claim **3**, wherein said upper support plate comprises an elongated opening, wherein said second upper compass arm has a pivot pin connected thereto which extends within said elongated opening of said upper support plate for effecting the slidable connection of said second upper compass arm to said fixed frame, and wherein said lower support plate comprises an elongated opening, wherein said second lower compass arm has a pivot pin connected thereto which extends within said elongated opening of said lower support plate for effecting the slidable connection of said second lower compass arm to said fixed frame.

5. The linkage assembly of claim **3**, wherein said first upper auxiliary compass arm and said upper link, at their respective pivotal connections with said fixed frame, do not overlie one another, and wherein said first lower auxiliary compass arm and said lower link, at their respective pivotal connections with said fixed frame, do not overlie one another.

6. The linkage assembly of claim **5**, wherein said upper auxiliary compass arm and said lower auxiliary compass arm extend in the direction of said upper elongated support plate and said lower elongated support plate, respectively, and wherein, in said closed position of said leaf, an end of said upper auxiliary compass arm and an end of said lower auxiliary compass arm are adapted to be adjacent a vertical stile of said fixed frame, and wherein an end of said upper link and an end of said lower link are adjacent a respective end of said upper auxiliary compass arm and a respective end of said lower auxiliary compass arm, to thereby position the connections of said upper auxiliary compass arm and said upper link to said fixed frame as close together as possible and as close as possible to said vertical stile and to thereby position the connections of said lower auxiliary compass arm and said lower link to said fixed frame as close together as possible and as close as possible to said vertical stile.

7. The linkage assembly of claim **3**, wherein each of said second upper compass arm and said second lower compass arm are cambered in a middle portion, thereby permitting said upper link to be positioned between said second upper compass arm and said upper elongated support plate and thereby permitting said lower link to be positioned between said second lower compass arm and said lower elongated support plate in said closed position of said leaf.

8. The linkage assembly of claim **3**, wherein the pivotal connection between said first lower auxiliary compass arm and said lower elongated support plate is formed by a vertical spindle extending through said lower elongated support plate and said first lower auxiliary compass arm.

9. The linkage assembly of claim **8**, wherein said vertical spindle comprises a conical extremity which is contained within said first lower auxiliary compass arm, thereby enabling selective movement of said leaf about both of said horizontal axis and said vertical axis.

10. The linkage arm of claim **3**, wherein the pivotal connection between said first lower auxiliary compass arm and said lower elongated support plate is formed by a vertical spindle extending through said lower elongated support plate and said first lower auxiliary compass arm, and wherein said vertical spindle comprises an extremity which is contained within said first lower auxiliary compass arm and which has a diameter for enabling only rotational movement of said first lower auxiliary compass arm with respect to said extremity.

11. The linkage assembly of claim **1**, wherein said first upper auxiliary compass arm has a width which is at least equal to the combined widths of said second upper compass arm and said upper link, and wherein said first lower auxiliary compass arm has a width which is at least equal to the combined widths of said second lower compass arm and said lower link.

12. The linkage assembly of claim **1**, wherein said leaf comprises a lower angle member fitting within a recess of a rear stile and a lower rail of said leaf, said lower angle member comprising, extending through a lower edge thereof, a cylindrical recess for receiving a vertical spindle for permitting said vertical spindle to extend and to rotate relative thereto.

13. The linkage assembly of claim **1**, wherein said leaf comprises a lower angle member having a vertical wing and a horizontal wing fitting within respective recesses of a rear stile and a lower rail of said leaf, said lower angle member comprising, extending through a lower edge thereof, a cylindrical recess, wherein the pivotal connection of said first lower auxiliary compass arm to said leaf comprises said vertical spindle having a lower extremity fixed with respect to said first lower auxiliary compass arm and said vertical spindle extending within said recess, and wherein said lower angle member further comprises an opening formed in said vertical wing communicating with said cylindrical recess.

14. The linkage assembly of claim **13**, wherein said pivotal connection of said first lower auxiliary compass arm to said leaf further comprises a socket slidably mounted within said vertical wing of said lower angle

member for selectively engaging said vertical spindle, for preventing pivotal movement of said leaf about said horizontal axis, or disengaging said vertical spindle, for permitting pivotal movement of said leaf about said horizontal axis.

15. The linkage assembly of claim **13**, wherein said pivotal connection of said first lower auxiliary compass arm to said leaf further comprises a socket slidably mounted within said vertical wing of said lower angle member and including a lower face having a recessed hole of a diameter for selectively receiving said vertical spindle, for preventing pivotal movement of said leaf about said horizontal axis, or selectively disengaging said vertical spindle, for permitting pivotal movement of said leaf about said horizontal axis, wherein said vertical wing of said lower angle member further comprises a transmission rod extending affixed to said socket and vertically extending from said lower angle member, said transmission rod being adapted to be connected to a control mechanism for effecting said selective receiving and disengaging of said socket with said vertical spindle.

16. The linkage assembly of claim **13**, wherein said vertical wing of said lower angle member comprises an outward face having an opening therein which communicates with said recess, wherein an upper extremity of said vertical spindle is adapted to extend through said opening upon at least a maximum open position of said leaf pivoted about said horizontal axis.

17. The linkage assembly of claim **1**, wherein said main compass arm of said upper linkage assembly comprises an extremity having a part which, for movement of said leaf about said vertical axis, caps an upper portion of said leaf, and a vertical wing including an opening for selectively receiving a control rod for preventing movement of said leaf about said horizontal axis and disengaging said control rod for permitting movement of said wing about said horizontal axis.

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